Cloud and Radiation Data Sets

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Both in situ and satellite−derived cloud and radiation data sets are available for Arctic climate studies. The following list includes those that can potentially be used for the detection climate change. It does not include data sets collected during field experiments or data that do not constitute a time series. The temporal scales range from hourly to daily averages, covering periods up to two decades.

Existing Data Sets

Baseline Surface Radiation Network (*in situ*): BSRN is a project of the World Climate Research Programme with a goal of detecting changes in the earth's radiation field over long time scales. BSRN stations in the Arctic are at Barrow, Alaska and Spitsbergen. The Antarctic BSRN stations are Neumayer, Syowa, and South Pole.   All stations measure global, direct, diffuse, and longwave downward radiation. All but Syowa also measure shortwave and longwave upward radiation and have 3−hourly synoptic observations. Spitsbergen and Neumayer have instrument−measured cloud base height. The stations began measurements as part of the BSRN in 1992 and 1994. On the Web: http://bsrn.ethz.ch.

Edited Synoptic Cloud Reports Over the Globe (*in situ*):   Surface synoptic weather reports over the globe for the 10−year period from December 1981 through November 1991 were processed by C. Hahn, S. Warren, and others to provide a data set designed for use in cloud analyses. The information in these reports relating to clouds, including the present weather information, was extracted and put through a series of quality control checks. With this data set a user can develop a climatology for any particular cloud type or group of types, for any geographical region and any spatial and temporal resolution desired. On the Web: http://cdiac.esd.ornl.gov/epubs/ndp/ndp026b/ndp026b.htm.

AVHRR Polar Pathfinder (*satellite*): The AVHRR Polar Pathfinder composites are a collection of products for both poles, consisting of twice−daily gridded and calibrated satellite channel data and derived parameters at a 5 km spatial resolution. Data include five Advanced Very High Resolution Radiometer (AVHRR) channels, clear sky surface broadband albedo and skin temperature, viewing and illumination geometries, surface type mask, cloud mask, and time of acquisition. Data are composited onto two grids per day based on common local solar times and scan angle. The data set currently covers the period 1981−1998. The APP data set has been extended to include cloud properties, surface radiation, and top−of−atmosphere radiation. At present the years 1982−1993 have been processed.   An example is shown in Figure 1.   On the Web: http://nsidc.org/data/nsidc−0066.html and http://stratus.ssec.wisc.edu/projects/app.

TOVS Path−P (*satellite*): The TIROS−N Operational Vertical Sounder (TOVS) Polar Pathfinder (Path−P) dat set consists of gridded daily Arctic fields of atmospheric

temperature, water vapor, skin surface temperature, total effective cloud fraction, cloud top pressure and temperature, solar zenith elevation, surface pressure, turning angle between geostrophic wind and surface stress over ice, emissivity, boundary layer stratification and the geostrophic drag coefficient. Data are available for the period 1979−1998 at a resolution of 100 km. An example is shown in Figure 2. On the Web: http://nsidc.org/data/nsidc−0027.html.
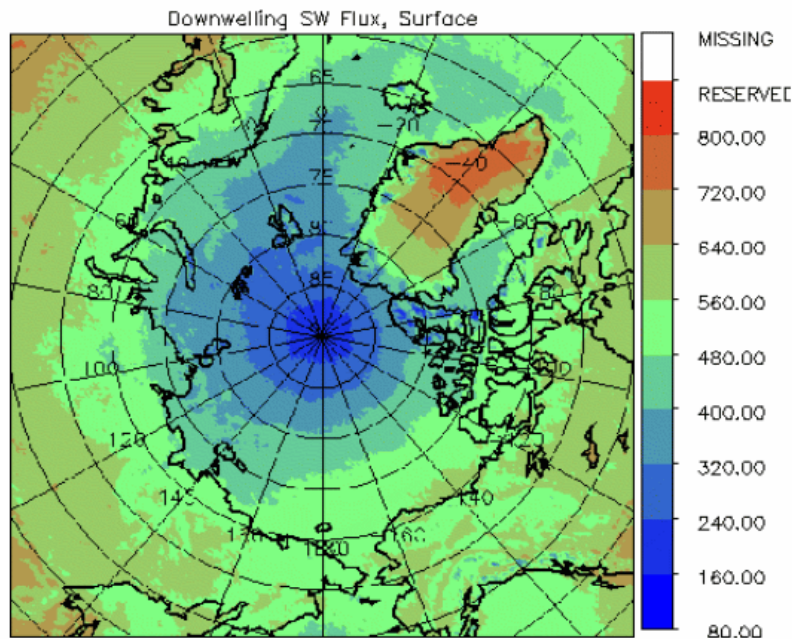

Fig. 1. Downwelling shortwave flux at the surface for the month of June, averaged over the period 1985−1993, calculated from the AVHRR Polar Pathfinder data set.

International Satellite Cloud Climatology Project (*satellite*): ISCCP was established as part of the World Climate Research Programme to collect and analyze satellite radiance measurements to infer the global distribution of clouds, their properties, and their diurnal, seasonal, and interannual variations. Variables include cloud amount, cloud optical depth (daytime), cloud temperature and pressure, cloud phase, surface clear sky temperature and visible reflectance. Data are currently available for 1983−1998 and will ultimately continue through mid−2002. The spatial resolution of the "D1" (3−hourly) and "D2" (monthly) data sets is 280 km, though a 30 km data set is also available. This is a global product. On the Web: http://isccp.giss.nasa.gov/products/onlineData.html.

Wisconsin HIRS Cloud Climatology (*satellite*): The High resolution Infrared Sounder (HIRS), part of the TOVS sensor suite, is also being used to generate a global cloud product at the University of Wisconsin. Variables include cloud amount, cloud emissivity and transmissivity, cloud height, and cloud temperature. The data set currently covers a 12 year period from 1989 to the present. The spatial resolution is two

degrees latitude by three degrees longitude. An example is shown in Figure 3.
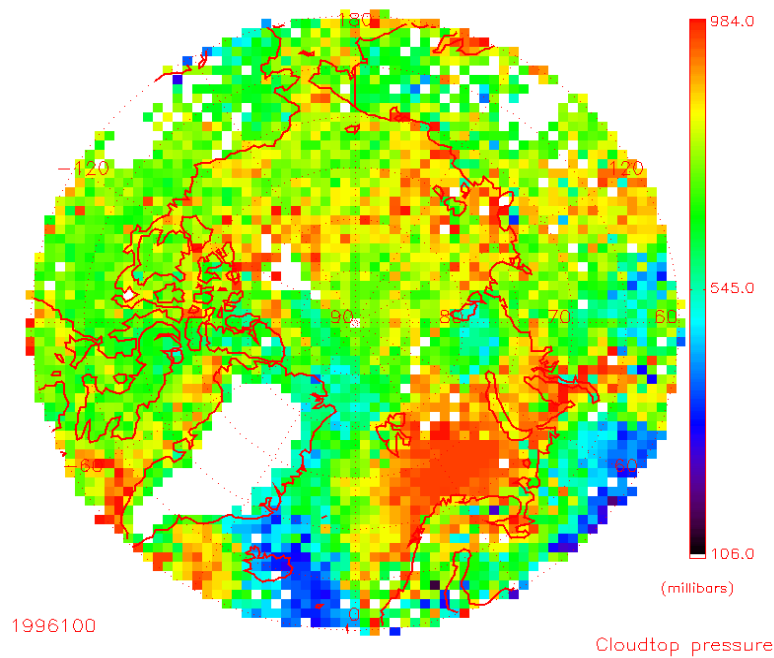On the Web: http://www.ssec.wisc.edu/~donw.

Fig. 2. Cloud pressure over the Arctic for 10 April 1996 from the TOVS Path–P data set.
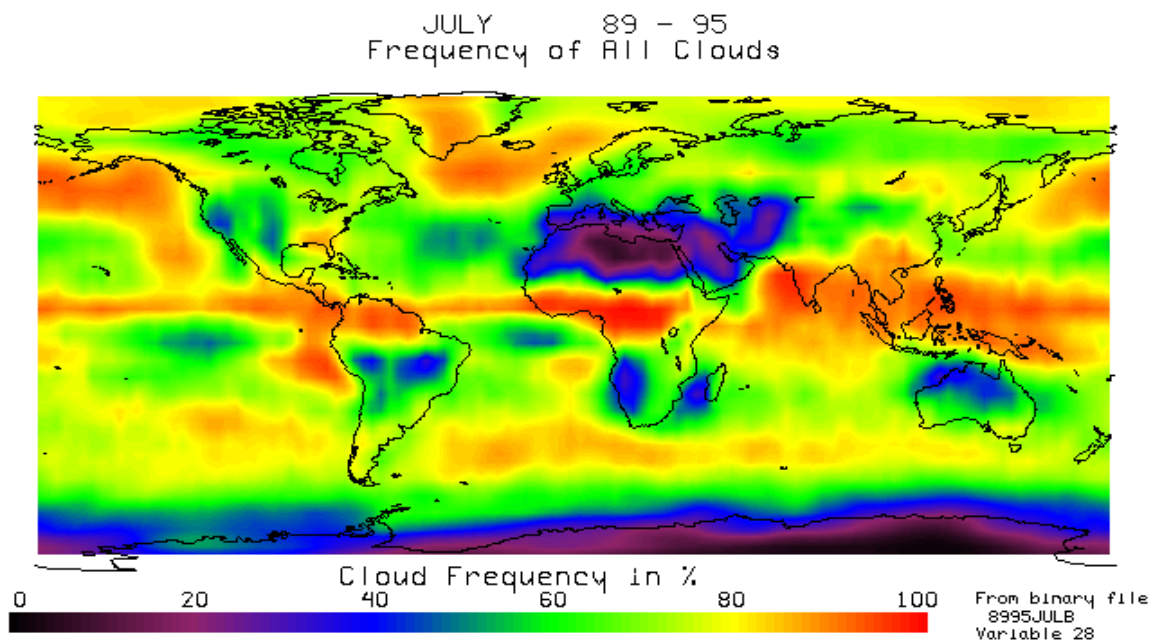

Fig. 3. Global cloud amount for July over the period 1989–1995 from the Wisconsin HIRS Cloud Climatology project.

Outlook: The Next Five Years

Some of the data sets described above will be extended to include additional years. The BSRN network will continue to collect data, the ISCCP data set will be processed through 2002, the extended APP data set will cover the years 1994–1998, and the Wisconsin HIRS cloud climatology will continue indefinitely (a related project will generate a 22 year climatology by mid–2002). Additionally, there is a possibility that the TOVS Path–P data set will be used to generate surface shortwave and longwave fluxes, providing another source of radiation information over a 20 year period. An example of the TOVS–derived surface radiative fluxes for the SHEBA year is given in Figure 4 (A. Schweiger, pers. comm.).
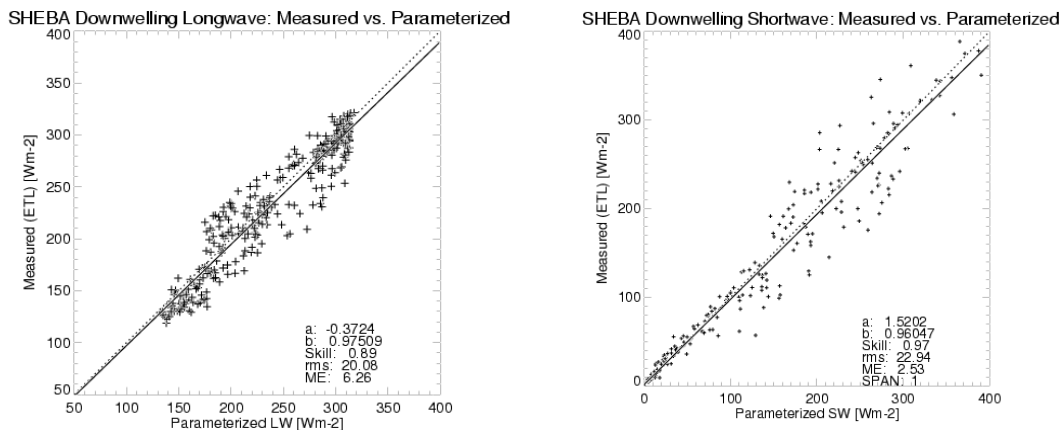

Fig. 4. Downwelling longwave (left) and shortwave (right) fluxes computed from the TOVS Path–P data set ("Parameterized") and measured at the surface over the SHEBA year.

References

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